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(54) Remote voice control system

(57) The remote control (RC) comprises a first wireless transmission channel (1) for controlling a device (TV), especially for a consumer electronics equipment, and a microphone (11) and a transmitter (3) for transmitting words spoken by a user via a second wireless transmission channel (2). The remote control therefore allows a user to control the respective device only via special command words. In addition to the control via words the remote control can be used in the traditional way via buttons on the remote control with the first transmission channel. Via a special button (B) on the remote control the second transmission channel is activated.

The second transmission channel (2) uses advantageously a radio frequency for the transmission and the command words are modulated in the remote control via a modulator (4) onto the carrier frequency of the second transmission channel. Advantageously FM-modulation can be used for transmitting the words analogue to a receiving unit (DS), with a radio frequency lying in the XYC-Band. The receiving unit comprises a circuit (10) for decoding the command words, comprising for example an analogue digital converter and digital signal processing means for comparing the command words with control words stored in a memory. Because only a limited number of command words is necessary for a remote control a reduced word set of control words can be used for better speech recognition providing a high probability for understanding or recognising words as a command. Special adjustments to the voice of a user or any learning systems are therefore not necessary.

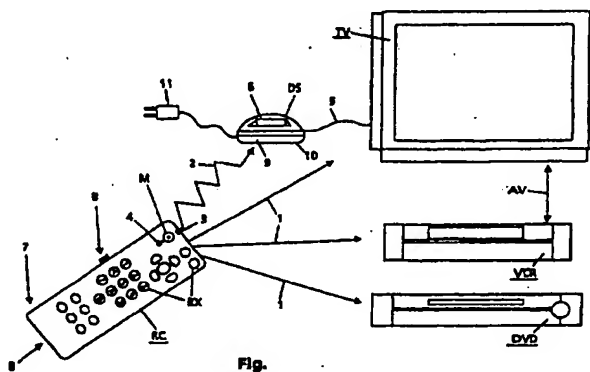


Fig.

Description

[0001] The present invention relates to a remote control with a wireless transmission channel for controlling a device, and to a corresponding receiving unit.

[0002] Remote controls for controlling a television set or other consumer electronics equipment are widely used and well known. They comprise a more or less large number of buttons to provide special commands for controlling the associated equipment. Buttons providing multiple functions or providing commands in connection with a display on the remote control or with an on-screen-display of the respective television set are also known. The commands of the remote control are transmitted via infra-red signals to a receiving unit of the corresponding device. Transmission of control signals via ultra-sonic waves is also known but rarely used.

[0003] A tendency exists also, to provide more universal remote controls for controlling several devices, for example a television set, a video recorder and a DVD player, or for controlling all units of a hi-fi system. In all cases there has to be found a compromise between an easy and understandable use of the remote control, without pressing too much buttons for a certain command, and to keep the remote control compact and providing not too much buttons which make the remote control too complex and expensive. For the buttons it is necessary to have an associated label for the respective command, mostly an abbreviation or a number, which need also a large amount of space on the top of the remote control.

[0004] It is the object of the present invention to provide a remote control as described above which allows an easy handling by a user.

[0005] This object is achieved by means of the features of the invention as specified in Claim 1. A receiving unit for a respective remote control is specified in claim 7 and a television receiver with a respective receiving unit in claim 12. Advantageous developments of the invention are specified in the subclaims.

[0006] The remote control of the invention comprises a first wireless transmission channel for controlling a device, especially for a consumer electronics equipment, and a microphone and a transmitter for transmitting words spoken by a user via a second wireless transmission channel. The remote control therefore allows a user to control the respective device only via special command words. In addition to the control via words the remote control can be used in the traditional way via buttons on the remote control with the first transmission channel. Via a special button on the remote control, the voice button, the second transmission channel can be activated. For example it might be more convenient for users which use a remote control only rarely or for older persons, to use the remote control only with words or for other persons to use the remote control as known with the buttons via the infra-red transmission channel.

[0007] The second transmission channel uses advantageously a radio frequency for the transmission and the command words are modulated in the remote control via a modulator onto the carrier frequency of the second transmission channel. Advantageously FM-modulation can be used for transmitting the words analogue to a receiving unit, with a radio frequency lying in the 70 cm wavelength band, or with a respective frequency depending on the country.

[0008] The receiving unit comprises a circuit for decoding the command words, comprising especially an analogue digital converter and digital signal processing means for comparing the command words with control words stored in a memory.

[0009] Because only a limited number of command words is necessary for a remote control a reduced word set of control words can be used for better speech recognition providing a high probability for understanding or recognising words as a command. Special adjustments to the voice of a user or any learning systems are therefore not necessary. The remote control comprises especially a difference microphone which allows a high suppression of background noises for example from other persons in the room or from the television set or the respective hi-fi system. Only words spoken directly into the remote control are recognised as command words. The microphone is located at the front on top of the remote control for easy handling. With the radio frequency transmission the remote control is not sensitive to the direction of the transmitter and the remote control can be held close to the mouth not pointing to the device to be controlled.

[0010] By using an analogue transmission channel the circuit effort in the remote control itself is comparatively low because all of the decoding means are arranged in the receiving unit. Additional power required in the remote control is especially necessary for the radio frequency transmitter. This can be handled easily by small rechargeable accumulators in the remote control.

[0011] By pressing the voice button the carrier frequency of the second transmission channel is activated which indicates the receiving unit that a spoken command will come. The button has to be pressed as long as the one or a few command words are spoken which is a handling to which a user will be accustomed to very quickly. In addition, the second transmission channel is equipped with a delayed switching off of the second transmission channel with a delay for example of about one second because a user may release the button too early, before he has ended the command word. With these features a high probability for the recognition of the correct command word is given.

[0012] In order to ensure maximum flexibility and reliability, a software that enables most people to operate the system is installed into the base unit. There are no learning phases. At the heart of the technology is a dedicated digital signal processor (DSP) which proc-

esses the signal. Speech, captured by the microphone, is transmitted by the second transmission channel to the receiving unit. Next the speech is digitised and then filtered to remove all background noise pollution. The significant parameters are then extracted by the application of techniques such as "Spectral Analysis" or "Linear Predictive Coding". The minimal units characterising all the sounds of a language such as phonemes are then retrieved and the various combinations processed subject to the word models in a data base memory, the data base comprising some hundreds of words.

[0013] Using the Hidden Markov Model (HMM) method, the sequences of phonemes are compared, applying a statistical and probability based theory, with the words and functions contained in the data base. Once the voice command is recognised a serial bus connection is used to communicate the command for example to a television set for execution.

[0014] The remote control can be used with different appliances and of multi-brand equipment. The receiving unit can be arranged especially as a separate docking station, which can be hooked up via a cable to a socket, for example of a television set, which most television sets are provided with for adjustment and repair service.

[0015] The invention is explained in more detail below by way of an example with reference to a schematic drawing, in which:

Figure: A remote control for controlling several appliances.

[0016] In the sole figure a remote control RC is shown for controlling a television set TV via a wireless infrared transmission channel 1. The commands for this transmission channel 1 are selected on the remote control RC via buttons BX as known. The television set TV comprises a respective infrared receiver and control means for decoding the infrared commands. Via the remote control RC also other appliances as a video recorder VCR or a digital video player DVD can be controlled.

[0017] The remote control RC comprises further a special button B for activating a second wireless transmission channel 2. The button B may be located at the side, or at the top, of the remote control for easy handling. Via the remote control RC words spoken by a user are transmitted via the second transmission channel 2 to a receiving unit DS in which these words are decoded and interpreted as commands for controlling the television set TV. The remote control comprises a microphone M and a transmitter 3 via which the command words are transmitted in an analogue manner to the receiving unit DS.

[0018] The transmitter 3 is advantageously a radio frequency transmitter working in the frequency range of 400 - 500 MHz. By pressing the button B on the remote

control the transmission channel 2 is active and a vocal link is enabled starting the RF-transmission of a pilot tone. The vocal link is active as long as the button B is pressed. When the user releases the button B the vocal link remains active for a short time-out, approximately one second in order to catch the end of the words spoken by the user. This time-out should not be too long because it could otherwise interpret words as commands, which the user did not intend. Via a modulator the words received by the microphone M are modulated analogue via FM frequency modulation onto the carrier frequency in a known manner and then transmitted via the transmitter 3, in this example with a frequency of 433 MHz, or other depending on the country, to the receiving unit DS which decodes the voice and communicates with the television set TV through a connecting cable 5.

[0019] As the microphone M a difference microphone with acoustic chamber is used to get best rejection of ambient noise and strongest signal from the user's voice. It has to be capable to identify words being whispered as well as words being very loud. The microphone therefore uses a membrane, which is open on both sides. The membrane is not elongated by sound waves which are further away because of their uniform distribution. Only when the remote control is held close to the mouth of the user, with a distance below 20 cm, the spoken words give a defined command signal.

[0020] The pilot tone with the FM signals of the transmitter 3 is received in the receiving unit DS which comprises a receiving element 9 for the second transmission channel 2 and a circuit 10 for decoding the command words into control signals for the television set TV. In the decoding circuit 10 the FM signals are downconverted and demodulated and then digitised, for example via an analogue digital converter. For digitising the words in the receiving unit DS a bandwidth of 6 kHz and 12 kHz sample rate is sufficient. With a digital processor the digitised command words are compared with control words stored in a memory and when correspondence between command word and control word is found the respective control signal is sent to the microprocessor of the television set TV.

[0021] Because only a limited number of commands are necessary for a remote control, for example several hundred, the decoding circuit 10 uses a reduced word set for a better speech recognition. With a reduced word set the words spoken by the user do not have to match perfectly with the stored words in the decoding circuit 10. The circuit can tolerate therefore different pronunciations and frequency signatures of different users. A learning system for adapting to the pronunciation of a certain user is not necessary, with the reduced word set a high probability for word recognition is obtained. Decoding circuits of this kind work already in cars in which a driver for example controls a mobile radio only with spoken words.

[0022] In this embodiment the receiving unit DS is

arranged as a separate docking station with own power supply, provided by mains power via a power line 11. It is provided with a port 6 for accommodating the remote control RC and comprises terminals for recharging the batteries 7 of the remote control RC via respective terminals 8 at the remote control. Via the cable 5 the control signals are transmitted to the television set TV being hooked up for example on a socket at the TV which is already available for maintenance and repair service. Via the cable connection AV the remote control RC can control also a respective video recorder VCR via the second transmission channel 2, or other appliances.

[0023] With the remote control switching to a wanted television channel, embedding pictures with picture-in-picture features, or setting the record function for a VCR by simply saying the completely intuitive keywords is very easy. The remote control with the respective receiving unit is capable, by means of its integrated voice recognition system, of understanding, interpreting and executing commands independent of any background noise, without any special learning being necessary. With its own microphone M, the remote control also has all the standard buttons BX which ensures that it is compatible for DVD, LD and Cable/SAT receivers as well as for the television set and the video recorder.

[0024] Into the software a special intelligent interface is incorporated which enables an on-screen display of messages for the voice command as programming screens, confirmation screens, etc. on the television set TV. The programming of the record function of the video recorder VCR is as easy as speaking. The remote control RC switches to voice mode when the button B is pressed and for controlling the respective appliance, only speaking within about 5 to 10 cm from the built-in microphone M of the remote control is necessary. By speaking the keywords intuitively, the request is immediately executed and a confirmation is displayed on the screen of the television set TV. For example the executed signal can be highlighted or underlined in the on-screen menu for confirmation. It is also possible to be guided by the voice help: the system then displays a menu, on the right of the television screen, which lists the control functions available and, as a reminder, the corresponding command words.

[0025] When a menu with control words is displayed the signal processor of the decoding circuit 10 checks only the control words as displayed on this screen with the spoken command words of the user. This feature improves the correct recognition of the command word further.

[0026] Recording with the videorecorder VCR then becomes a very simple operation: if a record is wanted now, saying just "record" and then "OK" is sufficient. A delayed recording can be set for up to seven days ahead by saying the day, the channel and the times for the start and the end of the recording.

[0027] In a further embodiment the top side of the remote control is designed very simple, only a few but-

tons are visible: voice button B, standby, volume, mute, program scroll and mode selection. Indicator lights for voice mode and for all other modes are further provided. All other buttons necessary for the variety of functions are hidden in the remote control with a flap. To operate the television manually or to operate the other appliances, the remote control, in its open position, has all the buttons needed for normal operation.

[0028] The system has been designed to ensure flexibility and simplicity, but still allowing immediately all available control functions for the respective television set and videorecorder with pressing the button B and saying the command word, without searching for the respective button on the remote control. Anyone can use the system directly without any prior learning phase, most voices in the same language are recognised.

Claims

1. Remote control (RC) with a wireless transmission channel (1) for controlling a device (TV), **characterised in** that the remote control (RC) comprises a microphone (M) and a transmitter (3) for transmitting words spoken by a user via a second wireless transmission channel (2) to said device (TV) for controlling said device via speech recognition.
2. Remote control according to claim 1, **characterised in** that said transmitter (3) is a radio frequency transmitter, working especially in the frequency range of 400-500 MHz, and that it comprises a modulator (4) for transmitting said words analogue via FM-modulation.
3. Remote control according to claim 1 or 2, **characterised in** that said microphone (M) is a direction sensitive difference microphone for noise cancelling.
4. Remote control according to one of the preceding claims, **characterised in** that the second transmission channel (2) utilises a pilot carrier for indicating to said device (TV) that speech is in progress, and that the remote control (RC) comprises a button (B) for activation of said pilot carrier and said second transmission channel (2).
5. Remote control according to one of the preceding claims, **characterised in** that said second transmission channel (2) being active as long as said button (B) is pushed, but with a delayed switching off, preferably one second, of said second transmission channel (2) with respect to releasing said button (B).
6. Remote control according to one of the preceding claims, **characterised in** that said first transmis-

sion channel (1) is an infrared transmission channel, and that said remote control (RC) comprises two infrared transmitters, one at the top and one at the bottom of the remote control, and further buttons (BX) to allow a user the control of said device (TV) via said first transmission channel (1) in addition to said second transmission channel (2).

7. Receiving unit (DS) for a remote control according to one of the preceding claims, **characterised in** that it comprises a receiving element (9) for said second transmission channel (2) and a circuit (10) for decoding said words via speech recognition into control signals for said device (TV).
8. Receiving unit according to claim 7, **characterised in** that said decoding circuit (10) comprises a reduced word set for better speech recognition.
9. Receiving unit according to claim 8, **characterised in that** with a spoken command transmitted via said second transmission channel (2) said decoding unit (10) arranges the opening of a control menu with commands on a respective TV screen, said control menu comprising said spoken command, and that the spoken command is highlighted in the control menu after being executed as a feedback for the user.
10. Receiving unit according to claim 8 or 9, **characterised in that** in said decoding circuit (10) only the control commands which are shown in a respective menu on the screen are compared with a following command word.
11. Receiving unit according to one of the claims 7 - 10, **characterised in** that it is arranged as a separate docking station being connected by a control cable (5) to said product (TV), and that it comprises a port (6) with terminals for accommodating said remote control (RC) and for recharging a battery (7) of said remote control.
12. Television receiver, **characterised in** that it comprises a receiving unit according to one of the claims 7 - 10.

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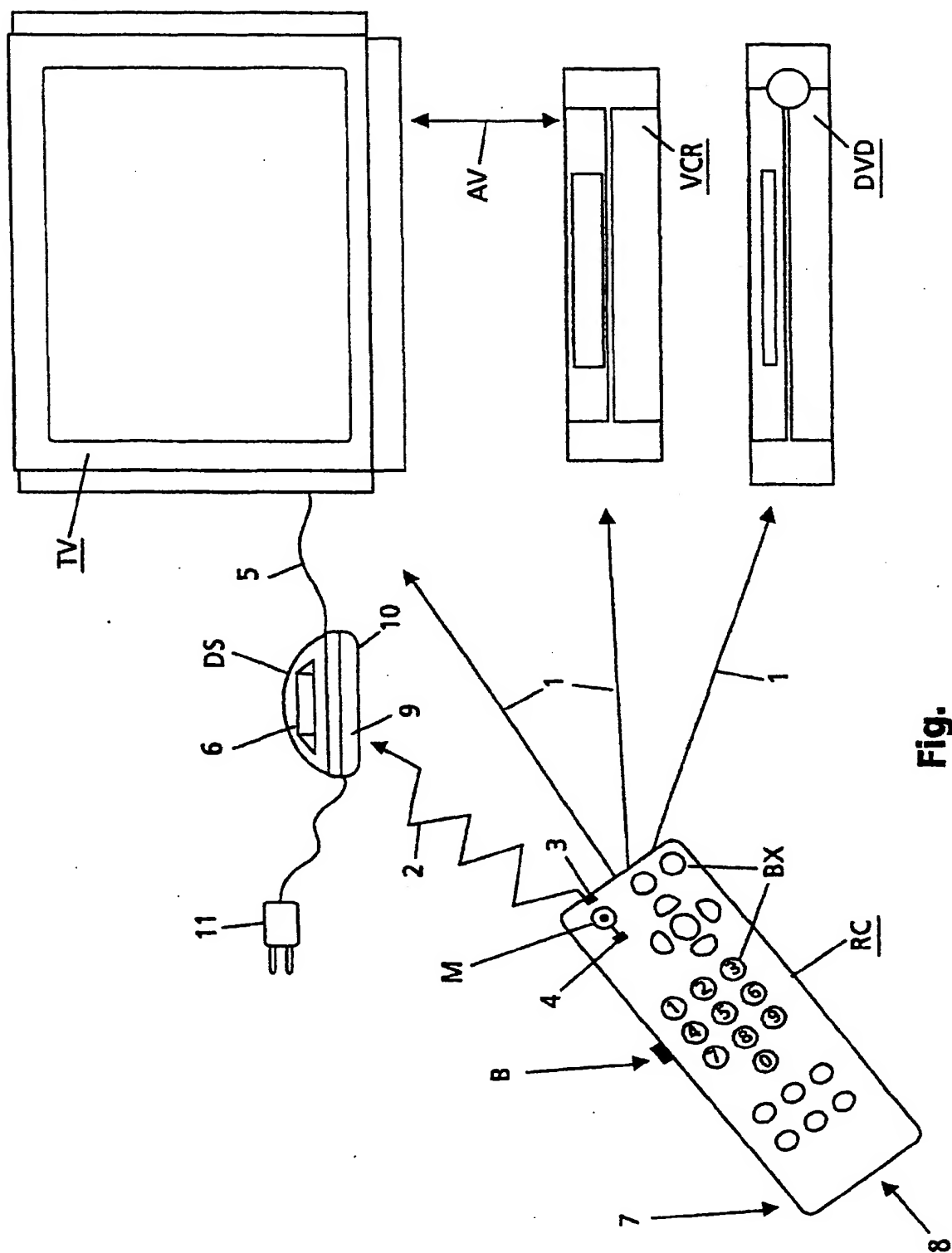


Fig.



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EUROPEAN SEARCH REPORT

Application Number
EP 99 11 6935

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7) 608C H04B
Place of search THE HAGUE		Date of completion of the search 28 March 2000	Examiner Pham, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 99 11 6935

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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